detrimentally because of the lighter weight of the seed.

Grass-grub

Grass-grub (*Costelytra zealandica*) is responsible for the destruction of a large area of pasture. The brown beetle, the adult stage of the grub, lays its eggs chiefly in November and December, about a month later than does the porina moth.

The grass-grub feeds entirely on the roots of the plants, leaving the foliage untouched. As a result of the root damage the plants die off and the soil is left spongy because of the activities of the grub under the surface. The damage is usually evident by early April, and the grub is recognisable by its whitish body, brown head, and horseshoe shape.

Grass-grub can be effectively controlled by DDT or lindane. The following are the suggested treatments: 1lb. of 100 per cent. DDT or lindane in 1000 gallons of water or 1½lb. to 3½lb. of 100 per cent. DDT or lindane per acre in topdressing or dry soil.

Porina

In contrast to the common grass-grub, the porina (*Oxycanus*) or subterranean grass caterpillar is a surface feeder affecting only the foliage or crowns of the plants. This pest, which is up to 2½in. long when fully grown, lives in single vertical burrows 6in. to 9in. below the surface of the soil, emerging at night to feed on the surface. Its colour is usually a greyish green and it has not the distinctive curving of the body which is characteristic of the grass-grub. The soil of an area infested with porina is not made spongy, but remains firm. Though grass-grub damage is most marked on light, friable soils, porina will cause trouble on quite heavy land.

Early recognition of the cause of damage is important. The presence of caterpillars may be recognised by soil casts on the surface which are distinguishable from worm castings by their fine web.

For some years poison baits of either paris green or arsenate of lead gave some control of the pest, but this treatment is less effective than applications of either DDT or lindane. Satisfactory treatments are: 3½lb. of 13 per cent. lindane in 1cwt. of superphosphate per acre or 1lb. of 13 per cent. lindane in 50lb. of bran per acre. (The use of double strength for high-return crops is recommended.) The pest can also be controlled by 2lb. of paris green in 25lb. to 30lb. of bran for populations of under 6 to the square foot.

Areas closed for seed production are particularly subject to attack by either grass-grub or porina.

Army Worms

Attack by the caterpillar known as the army worm may ruin a perennial ryegrass seed crop. This pest derives its common name from its habit of moving in large numbers in definite directions. It often does substantial damage in one paddock while another close by is untouched.

The caterpillar feeds on the foliage and seed heads of the plant, and a crop may be ruined almost overnight if infestation is severe.

An application of 2lb. per acre of 100 per cent. DDT has given good control. When this pest attacks ryegrass seed crops the most satisfactory method of application is by low-volume spraying with either aircraft or a ground plant.

Wheat Sheath Miner

Ryegrass is attacked by a fly (*Cerodonta denticornis*) commonly known as the wheat sheath miner because it also damages wheat. Injury to ryegrass is caused by the maggot or immature stage of the fly sucking the sap from the flowering stem, which results in a premature whitening and loss of the seed head.

The female flies of the wheat sheath miner, which are about 1/12in. long and greyish, emerge in early spring and within 3 days start laying their eggs in the blades of ryegrass. The fly punctures the blade and lays a single egg within the tissue. The egg-laying period lasts about 3 weeks, during which about nine eggs per day are produced. The young maggot hatches in a week and immediately begins to mine in the leaf tissue. As the insect grows its tunnels can be seen with the naked eye as zig-zagging white lines. When the damage is extensive the sap supply is cut off and the leaf wilts, turns brown, and dies. The maggot may then enter the developing flower stem and cut off the sap supply to the seed head, causing the whitening and loss of seed.

The maggot reaches maturity in 9 to 24 days, according to the season. At this period it comes to rest between the sheath and the flowering stem, where it turns into the puparium or resting stage. This puparium, especially when it is present in wheat, is sometimes confused with the "flax seed" stage of the hessian fly, which it resembles superficially. At this time the white straws are observable in the field, so that puparium is the stage in the pest's life history which is usually noticed. The time spent as a puparium is usually 2 weeks or less during summer, but autumn broods overwinter in old straw and grass and the flies emerge from the puparia in spring. Under suitable conditions the time taken from egg to adult is only a few weeks, and there are at least three generations in a season.

The wheat sheath miner is usually present in a ryegrass crop, but only periodically appears in sufficient numbers to be of any significance. A severe outbreak occurred in 1944 in North Canterbury, where in some severely damaged areas there were as many as seven and eight white straws per square foot, whereas other paddocks showed very few damaged straws. However, during the past 3 seasons no significant outbreaks have been reported.

This insect has been introduced into New Zealand and is now found throughout the country. For many years it has appeared periodically in isolated areas, but so far it has not been regarded as a serious pest of perennial ryegrass.

Seed Markets

About half a million acres of land is sown to pasture each year in New Zealand, and if a conservative figure of a bushel of perennial ryegrass seed to the acre is taken as the rate of seeding over the whole area, local consumption of seed is about 5000 tons a year. This figure is probably fairly constant, in contrast with the fluctuating quantities exported from year to year.

New Zealand exports about £250,000 worth of perennial ryegrass seed each year, principally to the United Kingdom and Australia. The bulk of the seed exported is certified, there being no great demand overseas for uncertified seed.

Importance of High Yields

On most farms the saving of perennial ryegrass seed is secondary to the growing of pasture for stock feeding. However, the fact that more than 25,000 acres must be harvested each year to meet local requirements alone indicates that the practice is important in suitable districts.

High prices for seed have encouraged seed harvesting in some districts and under types of management not really suitable. Though reasonable returns may have been received under these conditions, the importance of producing high yields of good seed must not be overlooked. By the application of those practices which will lead to high yields of seed and consequent lower unit costs the grower is at the same time encouraging higher consumption locally and making easier the finding of an overseas outlet for surplus supplies.

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